3.3 Energy

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3.3.1 Studies and Coordination

The primary reference used to document existing transportation conditions was *SR 509/South Access Road EIS Discipline Report: Transportation* (CH2M HILL January 2002). This report is included in this FEIS by reference. The primary resource used to guide the analysis of potential energy impacts was *Fundamentals of Traffic Engineering*, 14th Edition (Homburger et al. 1996). *Highway Capacity Manual,* Transportation Research, Special Report 209, 1997. This section qualitatively assesses potential energy impacts resulting from the construction and operation of each of the project alternatives.

Consideration of roadway design principles was used to qualitatively compare and contrast the probable energy consumption of each of the alternatives. The estimated cost of construction (exclusive of right-of-way costs) was used to represent both the amount of energy used to manufacture construction materials and the amount of energy used to operate construction equipment and worker vehicles. Six factors were evaluated and combined based on Homburger et al. (1996) to represent the amount of energy consumed in the operation of each alternative. These factors are: (1) the length of each roadway alternative, (2) the roadway design speed, (3) the terrain traversed by the roadway, (4) the traffic flow, (5) the estimated number of street signals, and (6) the estimated annual average operation and maintenance costs for each of the alternatives.

Table 3.3-1 provides an estimated cost for each of the above factors. These costs were ranked between 1 and 5 based on the effect on energy consumption, with 1 representing the lowest energy consumption. For example, the design speed for Alternatives B, C2, and C3 would be 70 miles per hour (mph) compared to posted speed limits of 25 to 35 mph of the existing roads or the No Action Alternative. Because 45 mph is considered the optimum speed in terms of energy efficiency, this value is ranked 2 in Table 3.3-1 because they have design speeds greater or lesser than 45 mph, and vehicles generally would consume more energy than vehicles traveling at 45 mph. The fewer street signals under Alternatives B, C2, and C3 are ranked higher in Table 3.3-1 compared to the No Action Alternative because more energy is consumed with increasing numbers of street signals. The summation and ranking for the variables allow the project alternatives to be compared for the several operation factors.

Table 3.3-1
Comparison of Energy Consumption by Project Alternative

A. Comparison of Values

	Construction	Operation-Use					Operation-O&M
	Cost [a] (millions)	Length	Design Speed	Terrain	Traffic Flow	Street Signals	O&M Cost/Year [b]
Alternative A (No Action)	0	NA[c]	25/35 mph[d]	rolling	poor	4+	0
Alternative B	$715 - $735	10.5 miles	70/60 mph[e]	rolling	good	0[f]	$295,000
Alternative C2 (Preferred)	$690 - $710	9.9 miles	70/60 mph[e]	rolling	best	0[f]	$295,000
Alternative C3	$695 - $715	10.2 miles	70/60 mph[e]	rolling	good	0[f]	$295,000

B. Ranking of Values (1=Low, Less Energy)

	Construction	Operation-Use						Operation-O&M	Operation	Overall Ranking[g]
		Length	Design Speed	Terrain	Traffic Flow	Street Signals	Average			
Alternative A (No Action)	1	1	3[d]	5	5	5	3.8	1	2.4	1.7
Alternative B	4	3	2	2	2	2	2.2	3	2.6	3.3
Alternative C2 (Preferred)	2	2	2	2	1	2	1.8	3	2.4	2.2
Alternative C3	3	3	2	2	2	2	2.2	3	2.6	2.8

[a] *Estimated construction costs (in 2000 dollars) provided by CH2M HILL on January 3, 2002. These cost estimates are preliminary and are subject to change during future design phases of the proposed project. Cost estimates do not include the 1,000 feet of the South Airport Link.*

[b] *Estimated operation and maintenance (O&M) costs (in 2000 dollars) include annual expenditures for highway and bridge maintenance, utilities, and maintaining ramp terminal signals. Because the approximate length of each of the alternatives is about the same, the comparison is between the No Action Alternative and any of the build alternatives.*

[c] *NA - Not applicable because there are multiple routes to I-5 from the current terminus of SR 509.*

[d] *The posted speed limits of the rural streets south of Sea-Tac Airport are between 25 and 35 mph.*

[e] *The design speed of the SR 509 lanes is 70 mph; the design speed of the I-5 C/D lanes is 60 mph.*

[f] *There would be no signal lights to stop traffic; street signals would be at each interchange on- and off-ramp.*

[g] *Overall ranking is the average of construction and operation total values.*

3.3.2 Affected Environment

The project area is located within a populated urban area of western King County dominated by commercial and residential development. The area is served by a freeway (I-5) and principal arterials (SR 99, South 188th Street, South 192nd Street, and South 200th Street). Minor and collector arterials also provide east-west access across the project area. The Tyee Valley Golf Course, Sea-Tac Airport, and facilities associated with the airport, are the prominent features in the north part of the project area. The I-5 corridor, which accounts for approximately 6.7 miles of the project area, is the prominent feature in the southern part of the project area.

Traffic Circulation

The existing SR 509 corridor consists of a four-lane freeway north of South 188th Street/12th Place South and a five-lane arterial street (South 188th Street). To the north, SR 509 has major connections to SR 99 and passes through the City of Burien; to the south, it passes through the Cities of Normandy Park and Des Moines, serving as a major connection to the regional system for residents. South of Des Moines, the SR 509 route currently is discontinuous between SR 516 and Dash Point Road in Federal Way. South of SR 516, the SR 509 corridor is coincident with SR 99 until it connects with Dash Point Road. Because of the circuitous routing to the south and poor connections to regional traffic generators (e.g., Sea-Tac Airport), the freeway portion of the corridor is underused, particularly between South 188th Street/12th Place South and SR 518.

Access to Sea-Tac Airport from the south is available from the arterial street system at South 182nd Street/SR 99. Local traffic can also access the North Access Expressway at South 170th Street. The primary regional access route from the south is I-5 (via SR 518 and the North Airport Expressway).

Traffic Volumes

Traffic on SR 509 north of South 188th Street/12th Place South is highly directional during the p.m. peak hour (when congestion is highest), with approximately 70 percent of the traffic traveling southbound. Between this point and South 216th Street, approximately 55 percent of traffic travels southbound and 45 percent northbound. Although there is heavy congestion on other freeways in the project area, SR 509 south of SR 518 carries a relatively low vphpl during the p.m. peak hour; in that section of roadway, the vphpl southbound is 1,150, while northbound it is only 500. In comparison, I-5 south of SR 518/I-405 carries 2,060 vphpl southbound and 1,390 vphpl northbound. The underutilization of SR 509 is due primarily to its poor connection to and from the south.

Traffic to and from the Sea-Tac Airport passenger terminal uses three major access points: North Access Expressway, South 170th Street to access expressway ramps, and the south entrance at approximately South 182nd Street. The highest volumes (1998) are on North Access Expressway, with a two-way p.m. peak-hour volume of more than 2,475 vph. The other two entrances have two-way p.m. peak-hour volumes of 1,220 and 1,130 vph, respectively. Trip distribution modeling for nonlocal traffic (i.e., traffic from outside the immediate influence area of Sea-Tac Airport) indicates that about 8 percent of the traffic is to or from the west, 18 percent to or from the east, 38 percent to or from the north, and 36 percent to or from the south. The Sea-Tac Airport peak hour generally does not coincide with commuter peak hours on adjacent roadways.

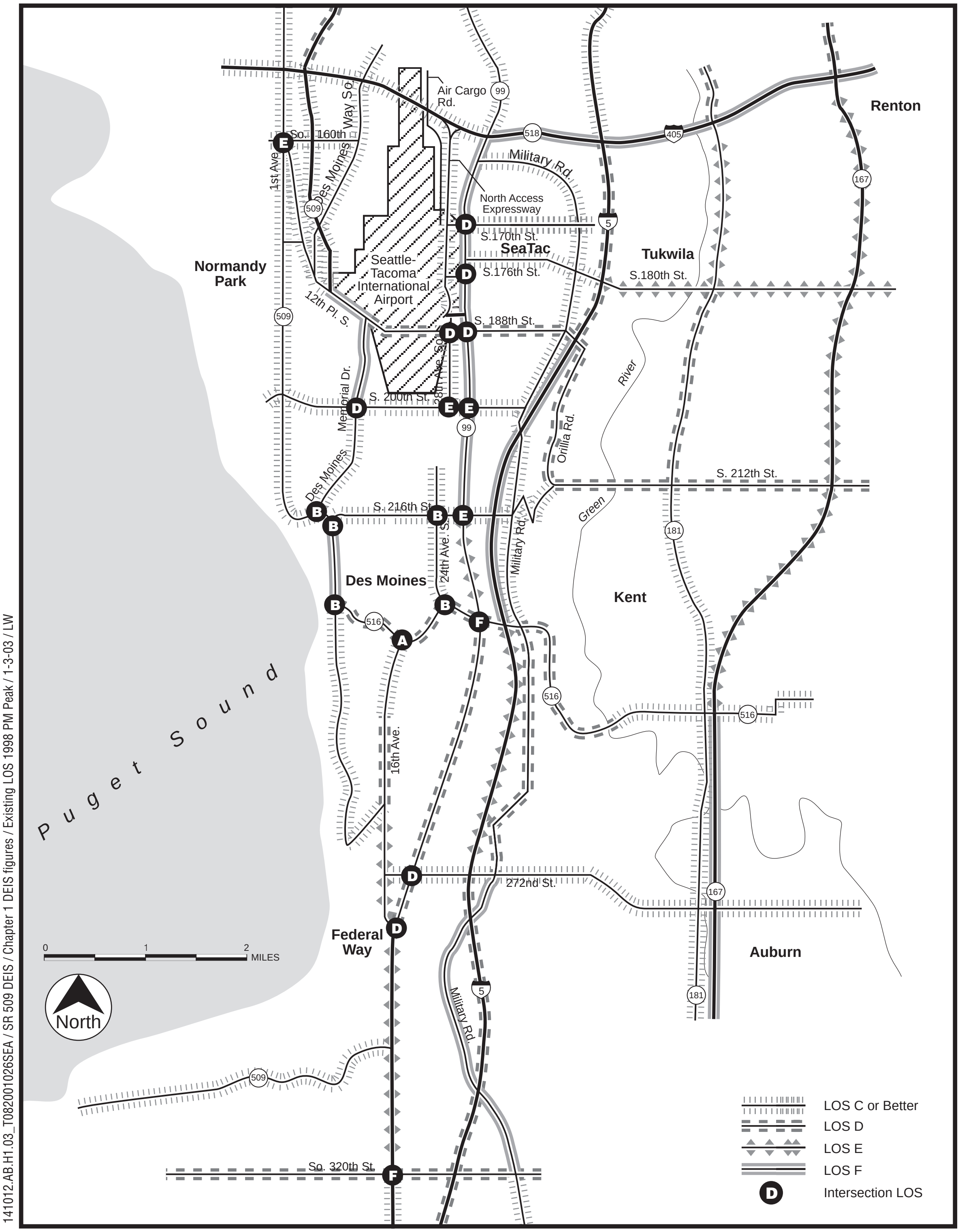
Level of Service

LOS is a qualitative description of the degree of comfort drivers experience as they travel along a corridor. LOS grades range from LOS A, in which little or no delay is experienced, to LOS F, which denotes extreme congestion. The TRB, in the *Highway Capacity Manual* (TRB 2000), provides definitions for each LOS grade.

Portions of the existing transportation system are highly congested during the p.m. peak hour. At the regional level, the I-5, SR 99, I-405, and SR 167 corridors are operating at LOS E or F. Portions of Des Moines Memorial Drive and SR 509 also are operating at LOS E and F. All of the signalized intersections along SR 99 operate at LOS D or worse. The intersections of First Avenue and South 160th Street and South 200th Street and 28th Avenue South operate at LOS E. The remaining intersections analyzed operate at LOS D or better (Figure 3.3-1).

In the SR 509 corridor, the freeway segment operates at LOS C to D. Immediately south of the freeway terminus, the SR 509 corridor operates at LOS C or better to South 216th Street. Most traffic uses Des Moines Memorial Drive between the freeway and South 216th Street rather than SR 509; as a result, portions of Des Moines Memorial Drive operate at LOS F. SR 509 operates at LOS F between South 216th Street and SR 516, where traffic volumes from SR 509 and Des Moines Memorial Drive merge. The arterial intersection at SR 509/SR 516 currently operates at LOS B.

Traffic on SR 509 through Des Moines has improved since 1992 as a result of completion of the Seventh Avenue South/Marine View Drive (SR 509) project, which added capacity in the corridor, and the additional work by WSDOT to improve the connections of First Avenue South and Des Moines Memorial Drive with Seventh Avenue South/Marine View Drive (SR 509) in the City’s downtown business district.



Note: Improvements made to SR 99 between South 170th Street and South 200th Street since 1999 have improved LOS within this roadway segment.

FIGURE 3.3-1

Existing Level of Service 1998 PM Peak Hour

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All of these road conditions degrade travel efficiency within the project area. The primary arterials have many controlled (signaled) intersections and many direct access driveways. Stop-and-go travel conditions are common on the minor arterial and collectors. These conditions deteriorate the LOS of the primary arterials and tend to increase travel times and peak-hour congestion. Collectively, these conditions require more fuel consumption than under ideal conditions.

3.3.3 Environmental Impacts

Future use of the roadways under any of the project alternatives, including the No Action Alternative, would continue to result in the consumption of energy. A number of qualitative factors affects the consumption of energy. A first level of comparison is the number of miles traveled between two points. For example, if the distance traveled is substantially greater under one project alternative than another, then the consumption of energy for the same vehicle is greater for the longer route. Higher design speeds (above 55 mph) tend to increase energy consumption. Hilly terrain increases the consumption of energy. Uninterrupted travel would decrease energy consumption. And numerous traffic signals would increase energy consumption due to stop-and-go operation and idling. In addition, the annual cost of roadway maintenance is a quantitative measurement of the amount of energy consumed during operation. Table 3.3-1 compares the No Action Alternative and the build alternatives.

Alternative A (No Action)

Traffic flow would continue to be congested through the commercial and residential districts of project area. Vehicle speeds would be expected to remain between 25 to 35 mph. Actual speeds would vary due to the lack of controlled intersections and the high number of turning lanes along the east-west and north-south roadways. During periods of heavy use, traffic flow would likely be stop-and-go due to congestion.

Under the No Action Alternative, the length of the roadway system would not change, posted speed limits would remain between 25 and 35 mph, the terrain would remain rolling hills, traffic flow would be more congested given a projected 30 percent increase in the numbers of vehicles over the next 20 years, the existing street signal timing would remain, and the annual roadway maintenance costs would remain more or less the same as they are today. As described in Section 2.3.1 only minor construction and safety improvements of the local roads would occur under this alternative. Based on the comparative scheme, the total average rating for the No Action Alternative would be 1.7 points, the least of any of the build alternatives (see Table 3.3-1). Energy consumption during construction would be less than any of the build alternatives, however, energy consumption during operation would be higher.

Alternative B

Under Alternative B (including both the I-5 improvements and the South Access Road), a new 10.5-mile-long controlled roadway would be constructed and operated. This alternative would have a design speed of 70 mph on a six-lane roadway traversing rolling terrain, good traffic flow, and no traffic signals except for the on- and off-ramps. Table 3.3-1 assigns a rating to these factors based on the values presented in the table and relative energy consumption. Annual roadway operation and maintenance costs are estimated to be $295,000. Based on relative ratings that represent energy consumption, Alternative B would be 3.3 points. According to this rating scheme, Alternative B would consume the most amount of energy of the build alternatives.

Alternative C2 (Preferred)

Under Alternative C2 (including both the I-5 improvements and the South Access Road), a new 9.9-mile-long controlled roadway would be constructed and operated. The roadway would be a six-lane roadway and approximately six-tenths of a mile shorter than Alternative B. This Alternative would have a design speed of 70 mph traversing rolling terrain, and would have the best traffic flow of any of the alternatives, including the No Action Alternative. Annual operation and maintenance costs are estimated to be $295,000.

Based on the qualitative rating of these factors and their relationship to energy consumption, this alternative rating would be 2.2 points. Alternative C2 is anticipated to result in the lowest levels of energy consumption of the build alternatives and would provide the best traffic flow.

Alternative C3

Under Alternative C3 (including both the I-5 improvements and the South Access Road), a new 10.2-mile-long controlled roadway would be constructed and operated. The roadway would be a six-lane roadway and approximately two-tenths of a mile shorter than Alternative B. This alternative would have a design speed of 70 mph traversing rolling terrain, and would have good traffic flow compared to the other alternatives, including the No Action Alternative. Annual operation and maintenance costs are estimated to be $295,000.

Based on the qualitative rating of these factors and their relationship to energy consumption, this alternative rating would be 2.8 points. Alternative C3 is anticipated to result in the second lowest levels of energy consumption of the build alternatives and would provide good traffic flow.

3.3.4 Mitigation Measures

Once a roadway project has been constructed, few mitigation measures can be implemented to affect the consumption of energy resources. The physical characteristics of the roadway are set and the traffic signals and signs have been installed. The most effective measure to reduce the consumption of energy would be to generally improve the energy efficiency (gas mileage) of the vehicles using the roadway system. This mitigation measure, however, is beyond the scope of this proposed project.

The operation of the build alternatives would not affect the availability of local or regional supplies of fuel. No additional supplies of energy would need to be developed to ensure long-term use of the proposed project, nor would the scope of the alternatives impact the production of energy. Lacking potential impacts resulting from the operation of any of the project alternatives in comparison to the availability, sources, and production of energy resources in the Pacific Northwest, no mitigation measures are proposed to address these issues.

3.3.5 Construction Activities and Mitigation

During the construction of transportation projects, energy consumption is typically quite high. The manufacture of building materials for road projects, as well as the materials themselves, consume energy resources. Workers typically drive to job sites in single-occupancy vehicles. Much of the construction equipment is motorized. The engines of backhoes, bulldozers, and cranes often idle for long periods each day. As a result, the amount of energy consumed in the construction of a transportation project is considerable.

Total construction cost is often used as a substitute value to compare energy consumption during the construction period. The cost of materials reflects the amount of energy consumed in the manufacture of the materials. The cost of labor is a measure of the number of workers commuting to the work site, as well as the amount of energy consumed operating the construction equipment. Some costs typically assigned to construction, however, do not directly correlate with the consumption of energy. For example, the acquisition of additional right-of-way does not consume energy. In addition, construction activities to relocate residences, businesses, and utilities consume energy, though these types of activities are typically excluded from construction cost estimates.

Table 3.3-1 presents a summary of cost estimates prepared for the proposed project. Dollar values and comparative ratings are displayed. The following paragraphs describe the construction cost estimates for the project alternatives as a measure to compare and contrast energy consumption.

Alternative A (No Action)

Under the No Action Alternative, only minor construction and safety improvements would be completed in the future. Expenditures during construction would be minimal and therefore, for comparison purposes, the cost estimate has been set at zero. In comparison to the build alternatives, the No Action Alternative would consume the least amount of energy.

Alternative B

The total cost of constructing Alternative B is estimated to be $715 to $735 million. With the highest estimated construction costs, which in part is related to its longer length, this alternative would consume more energy to construct than the No Action Alternative or the other build alternatives.

Alternative C2 (Preferred)

The total cost of constructing Alternative C2 is estimated to be $690 to $710 million (see Table 3.3-1). Based on the assumption that cost estimates can be used as a substitute value for energy consumption during construction, the cost estimates show that Alternative C2 would consume the least amount of energy to construct of any of the build alternatives and more than the No Action Alternative.

Alternative C3

The total cost of constructing Alternative C3 is estimated to be $695 to $715 million. Based on the assumption that cost estimates can be used as a substitute value for energy consumption during construction, the cost estimates show that Alternative C3 would consume about the same amount of energy to construct as Alternative C2 and more than the No Action Alternative.

Construction Mitigation

Major construction activities are proposed for each of the build alternatives. Only minor future construction is proposed for the No Action Alternative. Potential mitigation measures to reduce energy consumption during construction are briefly described below.

The magnitude of the construction activities proposed for the build alternatives would not affect the availability of local or regional supplies of fuel. No additional supplies of energy would need to be developed during construction, nor would the scope of the build alternatives impact the production of energy during the construction phase of the alternatives. Lacking potential impacts due to the relatively small scale of the project alternatives in comparison to the availability, sources, and production of energy resources in the Pacific Northwest, no mitigation measures are proposed to address these issues.

Alternative A (No Action)

No mitigation measures are necessary or proposed under the No Action Alternative to reduce energy consumption.

Alternative B

During construction, mitigation measures would be taken to reduce energy consumption. These mitigation measures could include the following: (1) encourage carpooling or vanpools among construction workers to minimize the number of vehicles used by workers to and from work and to reduce congestion at the start and end of construction shifts, (2) limit the idling of construction equipment to the extent practical; (3) plan for the delivery of equipment and supplies during non-peak traffic periods to minimize disruptions to both traffic and construction activities, and (4) locate staging/laydown areas as close as possible to work sites to minimize travel distances.

Alternative C2 (Preferred)

The mitigation measures suggested for Alternative B are equally appropriate to reduce construction-related energy consumption under Alternative C2.

Alternative C3

The mitigation measures suggested for Alternative B and C2 are equally appropriate to reduce construction-related energy consumption under Alternative C3.

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